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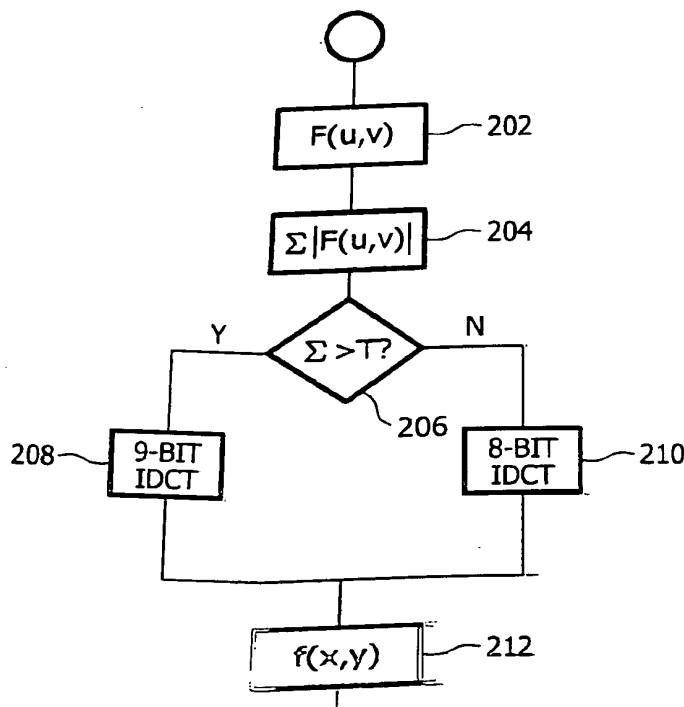
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[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR IMPROVED INVERSE TRANSFORM CALCULATION



(57) Abstract: A method is provided for determining, from DCT coded data used in MPEG video coding, the number of bits required to represent an output value which would be obtained after an inverse transform is performed on said transform coded data. The method comprises obtaining a sum of coefficient values within said transform coded data (204) and comparing this sum to a predetermined threshold value (206). As a consequence of said comparison a processor decides which inverse transform implementation, out of a number of pre-determined implementations, should be performed when decoding said transform-coded data (208, 210). For example, eight bit-processing routines may be used, which are more economic than nine bit routines if the sum is less than a threshold value.

WO 2005/033966 A3



Declaration under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *with international search report*

(88) Date of publication of the international search report:

6 July 2006

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/051918

A. CLASSIFICATION OF SUBJECT MATTER
G06F17/14 H04N7/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06F H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 349 395 A (SEIKO EPSON CORPORATION) 1 October 2003 (2003-10-01) paragraph '0070! - paragraph '0096! -----	1-19
X	ZHOU XUAN ET AL: "Method for detecting all-zero DCT coefficients ahead of discrete cosine transformation and quantisation" ELECTRONICS LETTERS, IEE STEVENAGE, GB, vol. 34, no. 19, 17 September 1998 (1998-09-17), pages 1839-1840, XP006010342 ISSN: 0013-5194 the whole document ----- -/--	1-19

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

2 March 2006

Date of mailing of the international search report

15/03/2006

Name and mailing address of the ISA

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NL - 2280 HV Rijswijk
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/ID2004/051918

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ZHOU M ET AL: "IDCT output range before clipping in MPEG video coding" SIGNAL PROCESSING. IMAGE COMMUNICATION, ELSEVIER SCIENCE PUBLISHERS, AMSTERDAM, NL, vol. 11, no. 2, December 1997 (1997-12), pages 137-145, XP004100330 ISSN: 0923-5965 page 137 - page 138 page 143 - page 145	1-9
A	RAMKISHOR K ET AL: "Method to improve accuracy in fixed-point implementation of IDCT" IEEE INTERNATIONAL SYMPOSIUM ON COMMUNICATIONS, CONTROL AND SIGNAL PROCESSING, BANGALORE, INDIA, JULY 2000, July 2000 (2000-07), XP002370380 Retrieved from the Internet: URL: http://www.geocities.com/ramkishor/papers/IDCT_Accuracy_CCSP.pdf 'retrieved on 2006-03-01! section II section III, first paragraph section III.B	5,6,14, 15
A	WO 00/01156 A (KONINKLIJKE PHILIPS ELECTRONICS N.V; PHILIPS AB) 6 January 2000 (2000-01-06) page 1, line 23 - page 2, line 2; figure 1 page 12, line 29 - page 13, line 17	5,6,14, 15
A	WO 99/35851 A (KONINKLIJKE PHILIPS ELECTRONICS N.V; PHILIPS AB) 15 July 1999 (1999-07-15) abstract; figure 1 page 5, line 4 - page 6, line 5; figure 2	5,6,14, 15

INTERNATIONAL SEARCH REPORT

In relation to patent family members

International Application No
PCT/IB2004/051918

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1349395	A	01-10-2003	CN 1449198 A	15-10-2003
			JP 2004007360 A	08-01-2004
			TW 221390 B	21-09-2004
			US 2003185300 A1	02-10-2003
WO 0001156	A	06-01-2000	EP 1040667 A2	04-10-2000
			JP 2002519956 T	02-07-2002
			US 2002027954 A1	07-03-2002
WO 9935851	A	15-07-1999	EP 0986914 A2	22-03-2000
			JP 2001516545 T	25-09-2001
			US 6400680 B1	04-06-2002

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference PHGB030173	FOR FURTHER ACTION	See item 4 below
International application No. PCT/IB2004/051918	International filing date (<i>day/month/year</i>) 29 September 2004 (29.09.2004)	Priority date (<i>day/month/year</i>) 02 October 2003 (02.10.2003)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant KONINKLIJKE PHILIPS ELECTRONICS N.V.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).

2. This REPORT consists of a total of 8 sheets, including this cover sheet.

In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

- | | | |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I | Basis of the report |
| <input type="checkbox"/> | Box No. II | Priority |
| <input checked="" type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> | Box No. VI | Certain documents cited |
| <input type="checkbox"/> | Box No. VII | Certain defects in the international application |
| <input type="checkbox"/> | Box No. VIII | Certain observations on the international application |

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Date of issuance of this report 07 June 2006 (07.06.2006)
Facsimile No. +41 22 740 14 35	Authorized officer Cecile Chatel Telephone No. +41 22 338 70 60

PATENT COOPERATION TREATY

PCT/IB2005/051918

From the
INTERNATIONAL SEARCHING AUTHORITY

To: see form PCT/ISA/220	<table border="1" style="margin: auto;"> <tr> <td style="padding: 2px;">REC'D</td> <td style="padding: 2px;">1 3 MAR 2006</td> </tr> <tr> <td style="padding: 2px;">WIPO</td> <td style="padding: 2px;">PCT</td> </tr> </table>	REC'D	1 3 MAR 2006	WIPO	PCT	<h2 style="margin: 0;">PCT</h2> <p style="margin: 5px 0 0 0;">WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)</p>
REC'D	1 3 MAR 2006					
WIPO	PCT					
Applicant's or agent's file reference see form PCT/ISA/220		Date of mailing (day/month/year) see form PCT/ISA/210 (second sheet)				
International application No. PCT/IB2004/051918		International filing date (day/month/year) 29.09.2004				
International Patent Classification (IPC) or both national classification and IPC G06F17/14, H04N7/26		Priority date (day/month/year) 02.10.2003				
Applicant KONINKLIJKE PHILIPS ELECTRONICS N.V.						

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☒ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA: <div style="display: flex; align-items: center;"> <div> European Patent Office - Glitschiner Str. 103 D-10958 Berlin Tel. +49 30 25901 - 0 Fax: +49 30 25901 - 840 </div> </div>	Authorized Officer Domingo Vecchioni, M Telephone No. +49 30 25901-666
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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**International application No.
PCT/IB2004/051918**Box No. I Basis of the opinion**

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
☐ a sequence listing
☐ table(s) related to the sequence listing
 - b. format of material:
☐ in written format
☐ in computer readable form
 - c. time of filing/furnishing:
☐ contained in the international application as filed.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**International application No.
PCT/IB2004/051918**Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability**

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 1-9

because:

☒ the said international application, or the said claims Nos. 1-9 relate to the following subject matter which does not require an international preliminary examination (*specify*):

see separate sheet

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the whole application or for said claims Nos.

☐ the nucleotide and/or amino acid sequence listing does not comply with the standard provided for in Annex C of the Administrative Instructions in that:

the written form

☐ has not been furnished

☐ does not comply with the standard

the computer readable form

☐ has not been furnished

☐ does not comply with the standard

☐ the tables related to the nucleotide and/or amino acid sequence listing, if in computer readable form only, do not comply with the technical requirements provided for in Annex C-*bis* of the Administrative Instructions.

☐ See separate sheet for further details

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**International application No.
PCT/IB2004/051918

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	10-19
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	10-19
Industrial applicability (IA)	Yes: Claims	10-19
	No: Claims	

2. Citations and explanations**see separate sheet**

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

International application No.

PCT/IB2004/051918

1. Reference is made to the following documents:

- D1: EP-A-1 349 395 (SEIKO EPSON CORPORATION) 1 October 2003 (2003-10-01)
D2: ZHOU XUAN ET AL: "Method for detecting all-zero DCT coefficients ahead of discrete cosine transformation and quantisation" ELECTRONICS LETTERS, IEE STEVENAGE, GB, vol. 34, no. 19, 17 September 1998 (1998-09-17), pages 1839-1840, XP006010342 ISSN: 0013-5194
D3: ZHOU M ET AL: "IDCT output range before clipping in MPEG video coding" SIGNAL PROCESSING. IMAGE COMMUNICATION, ELSEVIER SCIENCE PUBLISHERS, AMSTERDAM, NL, vol. 11, no. 2, December 1997 (1997-12), pages 137-145, XP004100330 ISSN: 0923-5965

Re Item III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

2. The methods according to claims 1 to 9 do not involve the use of any technical means and do not provide any tangible technical effect. The claimed methods can be realised by performing exclusively mental acts; the results of these methods are of a purely intellectual nature: a required number of bits is determined (claim 1), an appropriate inverse transform implementation is selected (claim 5).

The subject matter of claims 1 to 9 is, therefore, a method of performing purely mental acts as such (Rule 67.1(iii) PCT).

3. As a further evidence for this finding, it is noted that at least claim 1 embraces in its scope the purely intellectual exercise described in D3: a theoretical investigation of the maximal output range of the IDCT to decide on the required precision of an IDCT implementation in an MPEG decoder (see, in particular, page 143: theorem 3 with proof, in which a sum of coefficients is estimated (equation (25)), and conclusion "as the derived range [-1805,1805] is within the range [-2048,2047], 12 bit should be sufficient..." which implies a comparison with a threshold).

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

International application No.

PCT/IB2004/051918

4. As claims 1 to 9 relate to subject matter for which an International Preliminary Examination Authority is not required to carry out an international preliminary examination (Art. 34(4)(a)(i) and 34(4)(b) in combination with Rule 67.1 (iii) PCT), no opinion with regard to novelty, inventive step and industrial applicability is established for these claims in this communication.

Re Item V**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

5. The subject matter of claims 10 to 19 may be considered to be new (Art. 33(2) PCT) but does not involve an inventive step (Art. 33(3) PCT).
- 5.1 The subject matter of independent claim 10 addresses the problem of providing an apparatus for determining, from transform coded data, the number of bits required to represent an output value which would be obtained as a result of an inverse transform being performed on said transform coded data.

It is considered to be legitimate to include this aspect of the claimed apparatus in the formulation of the technical problem as, in the context of claim 1, this aspect does not form part of a solution to technical problem: claim 1 does not specify that and how the obtained information (the required number of bits) is used to achieve a technical effect.

It is obvious that a solution to this problem requires an estimation of the magnitude of the output. A skilled person, confronted with this problem, would find in several prior art documents (e.g. D1: equation (4) and corresponding text, D2: equation (2) and corresponding text) that the output of a discrete cosine transform can be estimated by the sum of the absolute values of the input vector coefficients. It is trivial that the same estimation can be used for the inverse discrete cosine transform (with a factor corresponding to the normalization factor used in the IDCT definition). It would therefore be obvious to the skilled person to provide for means for computing this sum and comparing it with thresholds for possible number of bits. Hence, claim 10 does not involve an inventive step (Art. 33(3) PCT).

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

International application No.

PCT/IB2004/051918

- 5.2 Similarly, the subject matter of independent claim 19 does not involve an inventive step (Art. 33(3) PCT).
- 5.3 The additional features of dependent claims 11, 12, 13, 16, 17, 18 do not appear to bring any inventive technical contribution going beyond the contribution of the subject matter of claim 1.
- 5.4 In contrast to claims 10-13 and 16-19, claim 14 specify that the obtained information on the required number of bits is used to decide which inverse transform implementation should be performed when decoding said transform coded data. However, merely deciding on an appropriate implementation without actually carrying out the selected implementation to decode the transform coded data does not result in a technical effect like optimised processor usage. Hence, the additional features of claim 14 do not appear to bring any inventive technical contribution going beyond the contribution of the subject matter of claim 1.
- 5.5 Similarly, the additional feature of claim 15 does not appear to bring any inventive technical contribution going beyond the contribution of the subject matter of claim 14 on which it is dependent.